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ARIZONA CORPORATION COMMISSION  
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May 1, 2015

Docket Control  
Arizona Corporation Commission  
1200 W. Washington  
Phoenix, AZ 85007

RE: Arizona Public Service Company ev-READY Study Annual Report  
Docket No. E-01345A-10-0123

Pursuant to Decision No. 72582 dated September 15, 2011, Arizona Public Service Company ("APS") was ordered as follows:

Arizona Public Service Company shall file annual reports, beginning in May 2012, detailing the development of the EV market within Arizona Public Service Company's service territory.

Attached please find the APS ev-READY Study Annual Report. If you have any questions regarding this information, please contact Kerri Carnes at (602)250-3341.

Sincerely,

Lisa Malagon

LM/sb  
Attachments

cc: Brian Bozzo

Arizona Corporation Commission  
DOCKETED

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# **ARIZONA PUBLIC SERVICE COMPANY**

## **ev-READY Study**

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Electric Vehicle Readiness Demonstration Study

Docket No. E-01345A-10-0123

## **ANNUAL REPORT**

May 1, 2015

**aps**

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## Executive Summary

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On August 8, 2011, Arizona Public Service Company (APS or the Company) filed its Electric Vehicle Readiness Demonstration Study (the ev-READY Study or the Study) with the Arizona Corporation Commission (Commission). As discussed in the Company's application, the ev-READY Study is designed to assist the Company and its customers in preparing for an increasing penetration of electric vehicles and plug-in hybrid electric vehicles (collectively referred to as EVs in this report) in the APS service territory in the next three years. APS developed the Study to provide tools for early adopters of EVs that will allow for the effective management and integration of an EV into both the customer's lifestyle and the APS distribution grid.

In Decision No. 72582 (September 15, 2011), the Commission declined to approve the ev-READY Study as proposed by the Company, citing the uncertainty surrounding market penetration and customer adoption of EVs and the availability of federally-funded EV incentive programs such as the Department of Energy's *The EV Project*.<sup>1</sup> APS was instead directed to closely monitor EV market penetration in collaboration with industry stakeholders and report annually on the status of EV adoption within the APS service territory. This report is the fourth ev-READY Study Annual Report.

In the Company's 2011 ev-READY Study application, APS estimated that approximately 957 EVs would be charging in the Company's service territory by the end of 2014. However, EPRI's Polk<sup>2</sup> sales data based on vehicle registrations show that there were 1,937 EVs registered in APS service territory at the end of 2014. In addition to EPRI's Polk sales data, APS customers self-identify as EV owners through the qualification process for the ET-EV rate. At the end of 2014, 729 customers residing in the Company's service territory self-identified as EV owners.

2014 was a banner year for electric vehicle sales; however, the deployment of EV charging infrastructure lagged in comparison to industry expectations in Arizona among other states. In response to this, several utilities across the country have developed plans to invest in EV infrastructure. In December of 2014, the California Public Utility Commission (CPUC) altered its

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<sup>1</sup> *The EV Project* is testing deployment and utilization of charging equipment in several major cities, including Phoenix. The Project was launched in October of 2009 with the intermediate goal of installing 14,000 EV charging stations (both residential and public) in 18 major U.S. cities. The lessons learned from the initial deployment of EVs and supporting charging station infrastructure are then expected to enable the Project's ultimate goal of streamlined deployment of the next 5 million EVs.

<sup>2</sup> Polk, a part of IHS Automotive, is an automotive data company that provides sales information for the automotive industry. EPRI has purchased Polk county vehicle sales data and provides the information as a service to their members (of which APS is one).



view of the regulated electric utility's role in EV charging infrastructure<sup>3</sup> by reversing a previous ruling which required utilities to demonstrate market failure or an underserved market as part of any request for authority to own EV charging infrastructure. This reversal was in response to "...near unanimity that the utilities should have an expanded role in EV infrastructure support and development in order to realize the potential benefits of widespread EV adoption" by EV stakeholders during rulemaking proceedings.<sup>4</sup> Since the CPUC's Decision, Southern California Edison (SCE), San Diego Gas & Electric (SDG&E), and Pacific Gas and Electric Company (PG&E) have proposed over \$1 billion in EV infrastructure plans. The CPUC is expected to review these proposals and reach a decision at the end of 2015.

In addition to SCE, SDG&E and PG&E proposals, Kansas City Power and Light and Georgia Power have started deployment of utility owned public EV charging infrastructure in their service territories. For convenience, these deployments are primarily focused on areas where people spend several hours parked. This additional infrastructure will help decrease range anxiety and enable more consumers, such as apartment dwellers, to purchase EVs.

Despite the uncertainty surrounding EV market penetration in 2011, the Commission recognized the importance of addressing expected impacts of residential EV charging behavior on the Company's distribution grid as early as possible during development of the EV market by approving the ev-READY Study Experimental Rate Schedule ET-EV. Rate ET-EV is a "whole house"<sup>5</sup> time-of-use (TOU) rate which incorporates a "super off-peak" time period designed to encourage off-peak EV charging, and provides APS with valuable data related to delivery system performance and customer charging behavior. The rate became available to customers in November of 2012.

An analysis on the impacts of Rate ET-EV can be found in Section II of this report. This analysis looks at the difference between Rate ET-EV and the E-12 Standard Rate. Rate ET-EV has shown to be an effective tool to drive charging to the super off-peak time period when demand on the system is lowest.

APS will continue to monitor EV market penetration, engage with industry stakeholders and other interested parties, streamline processes for data measurement and system operations, and evaluate Rate ET-EV throughout the following months.

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<sup>3</sup> Phase I Decision Establishing Policy to Expand the Utilities' Role in Development of Electric Vehicle Infrastructure, California Public Utilities Commission, Decision 14-12-079 dated December 18, 2014 in Rulemaking 13-11-007.

<sup>4</sup> *Id.*, page 5.

<sup>5</sup> A "whole house" rate measures all energy consumption at a residence, including energy necessary to charge an EV, through a single meter. All household usage is therefore subject to pricing signals contained in the rate.

## I. Development of the Electric Vehicle Market

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The ev-READY study was designed to assist the Company and its customers in preparing for the expected increase in market penetration of EVs in the near term. In the Company's ev-READY Study application, APS noted that uncertainty existed as to the percentage of vehicle sales that would be comprised of EVs over the next decade. However, the Company also noted that the DOE-funded *The EV Project*, which is supporting the development of the EV market by installing EV charging stations in eighteen major cities across the United States, has included the Phoenix and Tucson areas within the project. APS expected that, as a result of *The EV Project*, a higher percentage of APS customers would be among the early adopters of EVs. Despite a slower than expected market penetration rate, expected early adoption of EVs in the APS service territory increases the importance of developing and implementing a plan to seamlessly integrate EVs into the Company's distribution grid over the long term.

*The EV Project* targeted the deployment of approximately 900 EVs in the Phoenix and Tucson areas by the end of 2012, of which 350 to 500 were expected to be located in the Company's service territory. As of March 31 of this year, 729 EV owners living in the APS service territory have identified themselves to APS. In addition, EPRI's Polk sales data noted that through February of 2015 2,094 EVs were registered in APS's service territory.

Despite the recent unexpected drop in gasoline prices and lagging charging infrastructure development, the EV market has shown consistent, albeit low, year over year growth nationwide. Uncertainty regarding EV market penetration and customer adoption of EVs is significantly reduced compared to five years ago when EVs were first offered *en masse* to consumers. Despite EV's success over the last five years, EVs are still in the early adoption stage for consumer vehicles. Consumer concerns regarding range anxiety, high up front cost and battery life issues continue to hinder wide-scale growth. The total cost of ownership for an EV is now often cheaper than comparable conventional vehicles, and owners who have driven EVs for a few months often have their range anxiety subside as they become more comfortable with their vehicles.

2014 saw the release of six new electric vehicle models in the US market. In addition, nearly every major automaker has announced plans for future EV models to be released within the next three years, with eight new models expected later this year (see Table 1). Most notable of these announcements for future vehicles are Tesla and General Motor's commitments to release competing 200 mile range, \$35,000 EVs in 2017, both of which will be the highest range and lowest cost EVs ever offered to consumers.

Battery research continues in an attempt to address limited vehicle range and cost. Lithium ion batteries used in modern electric vehicles have seen

consistent declines in price and improved performance since EVs were mass introduced in 2010. With the promise to empower further battery price reductions, Tesla began construction of a large battery factory in 2014 outside of Reno, Nevada. The factory is expected to be capable of manufacturing 35 GWh of storage annually - enough to supply approximately 500,000 electric vehicles per year by 2020, with initial production expected to begin in 2017. Federal tax credits of up to \$7,500 are still available toward the purchase of an EV, dependent upon the battery capacity and gross total weight of the vehicle.<sup>6</sup> This continuing support, along with other advances in technology, keeps industry analysts' expectations of increased deployment of EVs high.

Table 1. Released and Planned Electric Vehicle Models through 2017

Vehicle Brand	Year Released				Planned Release Year		
	2010/ 2011	2012	2013	2014	2015	2016	2017
<b>Audi</b>					A3 e-tron - PHEV		
<b>BMW</b>		Active E - BEV		i3 MCV - BEV i8 - PHEV	X5 - PHEV		
<b>Cadillac</b>			ELR - PHEV				
<b>Coda</b>		All Electric Car - BEV					
<b>Chrysler</b>						Town and Country - PHEV	
<b>Fiat</b>			500e - BEV				
<b>Fisker</b>	Karma S - PHEV						
<b>Ford</b>		C-Max Energi - PHEV Focus Electric - BEV	Fusion Energi - PHEV				
<b>GM</b>	Volt - PHEV	Spark - EV					Bolt - BEV
<b>Honda</b>		Fit - BEV	Accord - PHEV				
<b>Hyundai</b>					Sonata - PHEV		
<b>Infiniti</b>						Infiniti LE - BEV	
<b>Jaguar</b>					C-X75 - PHEV		
<b>KIA</b>				Soul EV - BEV			
<b>Mercedes</b>				B Class - BEV	C350 - PHEV S550 - PHEV		
<b>Mitsubishi</b>	iMiev - BEV					Outlander (USA) - PHEV	

<sup>6</sup> Internal Revenue Code (IRC) 30 (Plug-in Electric Vehicles) and IRC 30D (Qualified Plug-in Electric Drive Motor Vehicles).



	Year Released				Planned Release Year		
<b>Nissan</b>	Leaf - BEV						
<b>Porsche</b>			918 Spyder - PHEV Panamera S E-Hybrid - PHEV	Cayenne - PHEV			
<b>Scion</b>		iQ - BEV					
<b>Smart</b>		ForTwo Electric - BEV					
<b>Toyota</b>		Prius - PHEV RAV4 - BEV					
<b>Tesla</b>	Roadster - BEV (2008)	Model S - BEV			Model X - BEV		Model 3 - BEV
<b>Volkswagen</b>				E-Golf - BEV		Cross Coupe - PHEV	
<b>Volvo</b>					XC90 T8 - PHEV	V60 - PHEV	

**BEV** = Battery Electric Vehicle; **PHEV** = Plug-in Hybrid Electric Vehicle

APS is working with EV infrastructure contractors to monitor the EV market, both in Arizona as a whole and specifically in the Company's service territory.<sup>7</sup> The Company participates in the EVAZ Stakeholder Group, a group of EV infrastructure manufacturers, auto dealerships, government organizations, utilities, and other industry observers based in Arizona. Meetings of the group are held regularly and participants share information on EV-related programs, successes and challenges. The group is also developing policies that are intended to advance the adoption of EVs within the state.

Company personnel also regularly attend EV industry conferences to network with other utilities, infrastructure developers, and auto manufacturers to maintain a high level of awareness of industry trends and to build a network of information specialists. In 2013, the Company completed the deployment of a pilot program working with Ecotality, the program manager and installation partner for *The EV Project*, which integrated electric vehicle charging infrastructure with photovoltaic systems. In 2014, the Company began electrifying its vehicle fleet by implementing policies and procedures to procure EVs wherever possible. The Company began the fleet electrification process with 10 Chevrolet Volts, one Ford Fusion Energi, two plug-in hybrid VIA pickup trucks, and two plug-in hybrid Odyne bucket trucks. The VIA and Odyne trucks are part of a Department of Energy and EPRI research program.

<sup>7</sup> "IT IS FURTHER ORDERED that Arizona Public Service Company shall work cooperatively with the federally-funded EV infrastructure contractors for the first year of the proposed Study." Decision No 72582, page 15 lines 5-6.

## A. Availability of Electric Vehicles

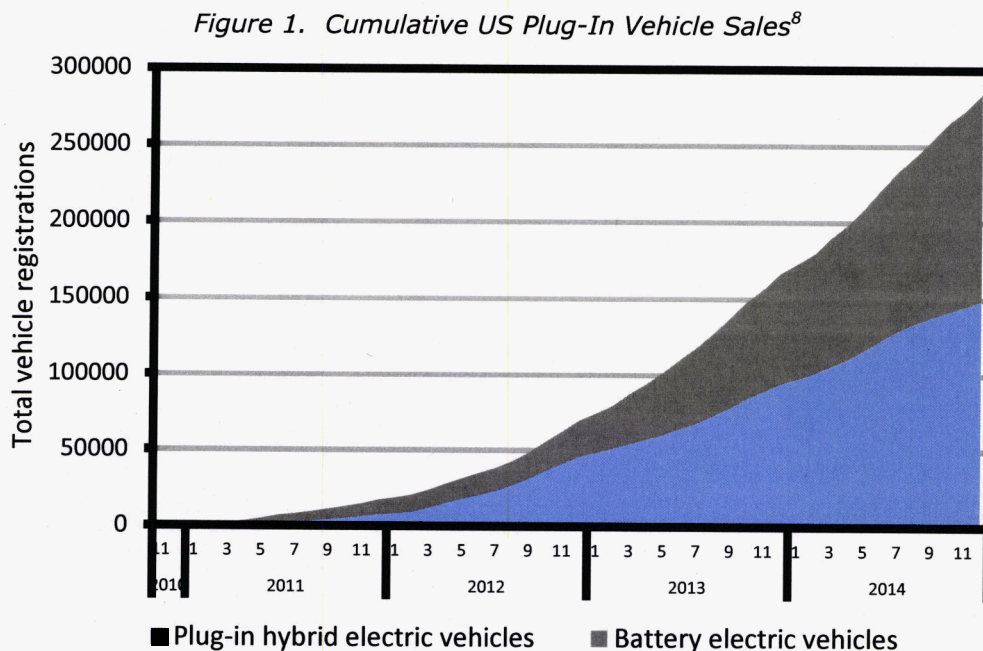
The first widely available EVs were deployed in the United States in the later part of 2010 and into 2011. Adoption of these vehicles by consumers during this period was lower than expected amid delays in vehicle availability, the largest of which was the impact of the Tohoku earthquake and tsunami in Japan in March of 2011 on the ability of Japanese car manufacturers to ship product to the United States. Other delays in EV availability included technical difficulties such as software glitches and vehicle component breakdowns, including battery failures.

In 2012, the EV market saw an uptick in the market as Nissan, GM, and Tesla all increased production and sales volume. Overall there were 52,800 plug-in vehicles sold in the US in 2012, more than 5 times the cumulative total at the start of the year.

EV market penetration increased again in 2013 with 96,702 plug-in vehicles sold in the US, an increase of 83% over the previous year.

In 2014 the EV market experienced another year of strong sales with approximately 117,000 plug-in vehicles sold in the US, an increase of 22% since 2013.

Figure 1 below shows the cumulative plug-in vehicle sales in the United States.



<sup>8</sup> Source: EPRI Polk Sales Data

## 1. Market Participants

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In 2014, the top three models of EV remained the Nissan LEAF; the Chevy Volt, and the Tesla Model S. Additionally, customers were able to purchase several smaller-market vehicles, each with differing attributes and price points.

The Nissan LEAF (Leading Environmentally-friendly Affordable Family car) is an all-electric vehicle with an estimated range of 100 miles. Deliveries to United States consumers that had pre-ordered vehicles began in December of 2010. In 2014, Nissan sold approximately 30,000 cars in the United States, a 36% increase over 2013. The new 2015 model has an MSRP of \$29,010; but with a federal tax rebate of \$7,500, the price of a new Nissan Leaf becomes \$21,510.

In contrast, the Chevrolet Volt is advertised as an extended-range EV with an initial range on an electric charge of approximately 38 miles. Once the car battery is depleted, a gasoline engine powers an electric generator to extend the car's range. The Volt became widely available in the United States by June of 2010. In 2014 Chevy sold approximately 18,500 Volts, about 20% less than in 2013. For 2015, the Volt has a MSRP starting at \$34,170 or \$26,670 with the federal tax rebate of \$7,500. In the second half of 2015 Chevy is expected to release its highly anticipated 2016 model year Volt which will have redesigned styling and an EPA estimated battery range of 50 miles.

The high-end Tesla Roadster was also available until the end of 2011. The Roadster is an all-electric vehicle using a lithium-ion battery, which has an advertised range of approximately 245 miles. It was the first highway-capable EV in production and available in the United States, although with a price of over \$110,000, the Roadster was not planned as a mass-produced vehicle. Tesla sold approximately 2,100 vehicles through the end of 2011, but its production has since been halted in favor of Tesla's next generation EVs. Tesla has offered continual upgrades to Roadster owners, most recently announcing the Roadster 3.0 package which boosts the range by 30-40% resulting in a 340 mile battery range on a single charge.

The Tesla Model S is an all-electric vehicle using a lithium-ion battery, with ranges of 240 and 270 miles depending on the size of the battery. The cost of the Model S starts at \$75,000 for the 240 mile battery. Tesla sold approximately 14,400 Model S vehicles in 2014.

BMW released its second all-electric vehicle in 2014, the BMW i3. The BMW i3 is a battery electric vehicle with an EPA estimated range of 81 miles starting at \$42,400 without incentives. The i3 also offers a "range extender" option which includes a gasoline generator that offers 150 miles of total range and



starts at \$46,250 without incentives. BMW sold approximately 4,300 i3s in 2014.

Figure 2.  
Nissan LEAF



Figure 3.  
Chevy Volt



Figure 4.  
Tesla Model S



Figure 5.  
BMW i3



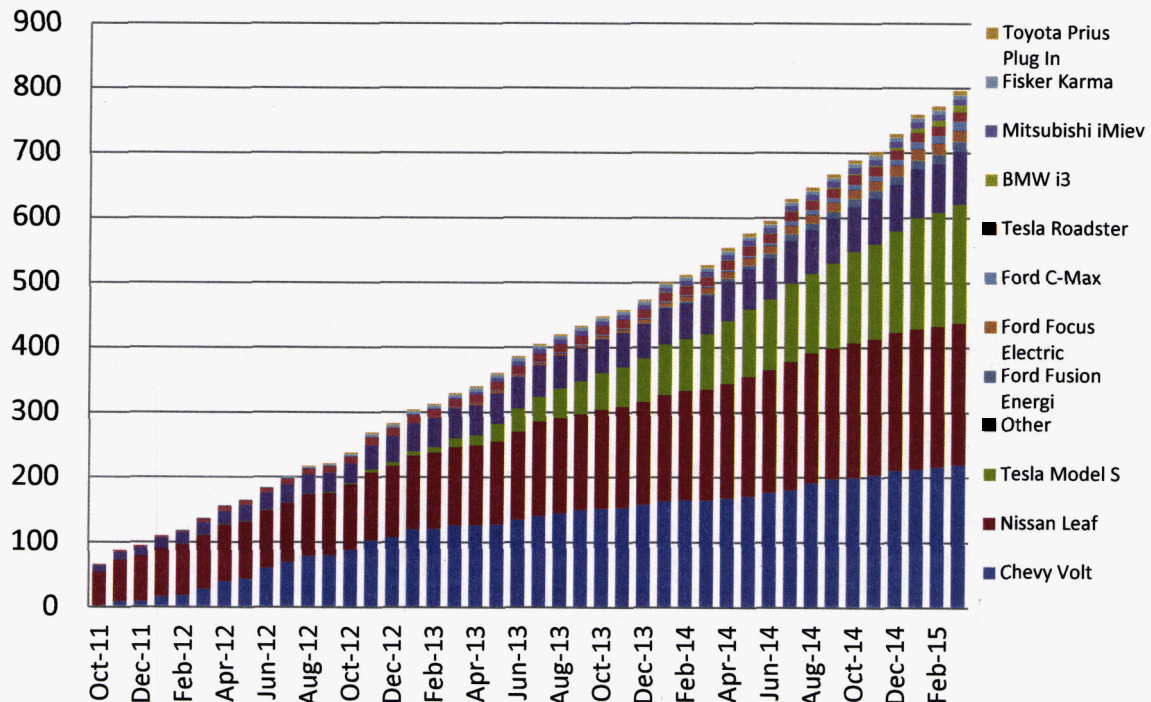
By the end of 2014, several other EV models were available for purchase, including the BMW i8, Kia Soul EV, Mercedes B-Class, Porsche Cayenne, Volkswagen E-Golf, Fiat 500e, Honda Accord Plug-In Hybrid, Mitsubishi iMiev, Fisker Karma, Ford Focus Electric, Ford C-Max Energi, Ford Fusion Energi, Toyota Prius Plug-In, Toyota RAV4 EV, Daimler Smart Electric Drive (Smart ED), the Mini-E, Coda Electric, Scion iQ, BMW Active-e, and the Porsche Panamera Electric. Many of these EVs were only released in select markets which contain more charging infrastructure and government incentives, thus they were not all widely available in Arizona in 2014. Given Arizona's proximity to California, some customers have purchased these less common vehicles and shipped them to Arizona. EV models and production numbers planned for the coming years have grown significantly, creating higher expectations of EV market penetration growth in the upcoming years.

## 2. Electric Vehicles in the APS Service Territory

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As of the end of 2014, APS has identified 729 EVs, by service address, that are regularly being charged throughout the Company's service territory. The vast majority of these EVs are Chevy Volts (224), Nissan LEAFs (220), and Tesla Model S's (194); however, 17 Ford Focus Energis, 17 Ford Focus Electrics, 14 Ford C-Max Energis, 14 Tesla Roadsters, 11 BMW i3s, nine Mitsubishi iMIEVs, seven Fisker Karmas, five Toyota Prius Plug-Ins, and 82 other EVs have been purchased by APS customers (see Figure 5).

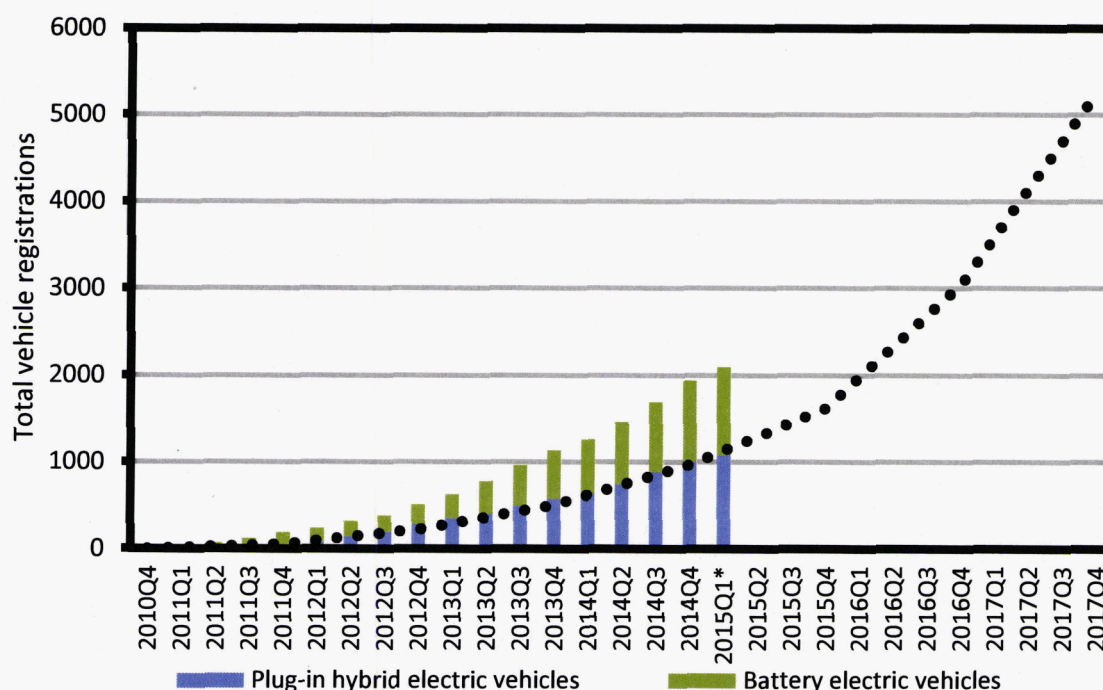
Figure 5. Cumulative Number of EVs Self-Identified in APS Service Territory by Model



APS customers self-identify as EV purchasers. The Company learns of the individual EV purchaser through customer phone calls to learn about services or other rate options available to EV owners. For the second year, EPRI provided Polk sales data to their Electric Transportation Program sponsors. Polk sales data is motor vehicle registration data that shows vehicle model registrations in each county. The county registrations are used to estimate how many vehicles in Arizona are in the Company's service territory. The most recent Polk sales data indicates that there were approximately 2,094 EVs registered in the Company's service territory through the end of February 2015. This strongly suggests that there are, in fact, as many as 1,365 EVs in APS' service territory for which the Company has no data on charging equipment or service address (see Figure 6 below). Figure 6 shows the cumulative number of new electric vehicles registered each quarter in APS service territory. In addition, the graph plots historical hybrid vehicle sales data from its initial market introduction in the early 2000s. This information can be used as a benchmark for expected adoption trends for electric vehicles.



Figure 6. Electric Vehicles in APS's Service Territory Through February 2015



As discussed in the Company's ev-READY Study, APS utilizes information on EV purchases to determine the ability of existing transformers to absorb the additional electric load of EVs being charged within a specific neighborhood. As part of the ev-READY Study, the Company has developed processes and procedures to ensure safe and reliable integration of EVs into the local distribution grid, including the mapping of known EVs.

APS conducted educational outreach efforts in 2014 to re-educate automobile dealers and EV owners on both the importance of utility notification and the ET-EV rate with the goal of timely reporting of EVs in the Company's service territory. However, due to the large discrepancy between the number of self-identifying APS EV customers (Figure 5), and the number of APS owners according to Polk data (Figure 6), APS may need to implement a more robust outreach program for reporting EVs. The addition of 1,365 EVs to our database may indicate significantly more clustering than currently known. Figures 7 and 8 show known transformers where customers have self-identified as charging their EVs.



Figure 7. Known Transformers Serving EVs in the APS Service Territory

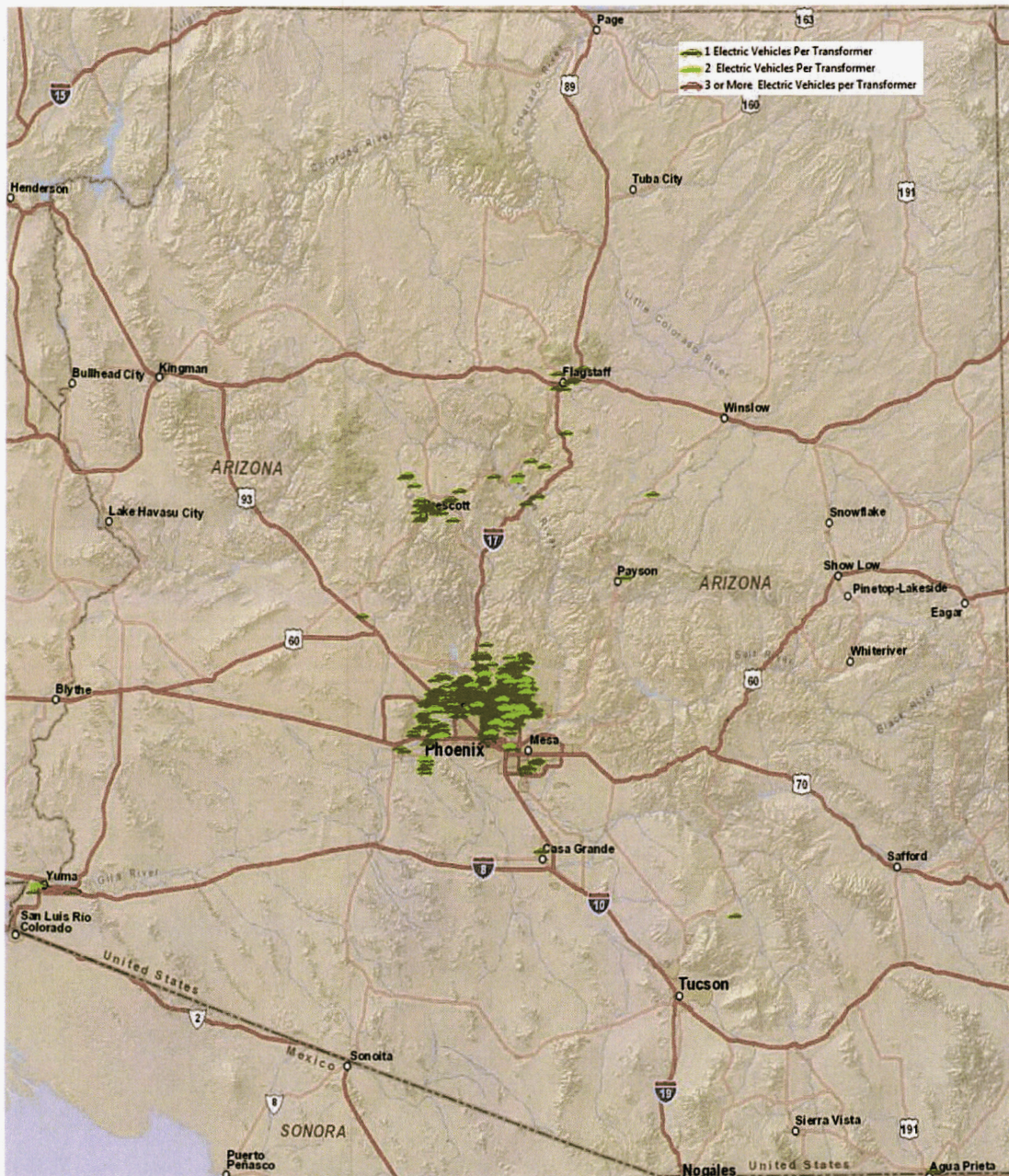
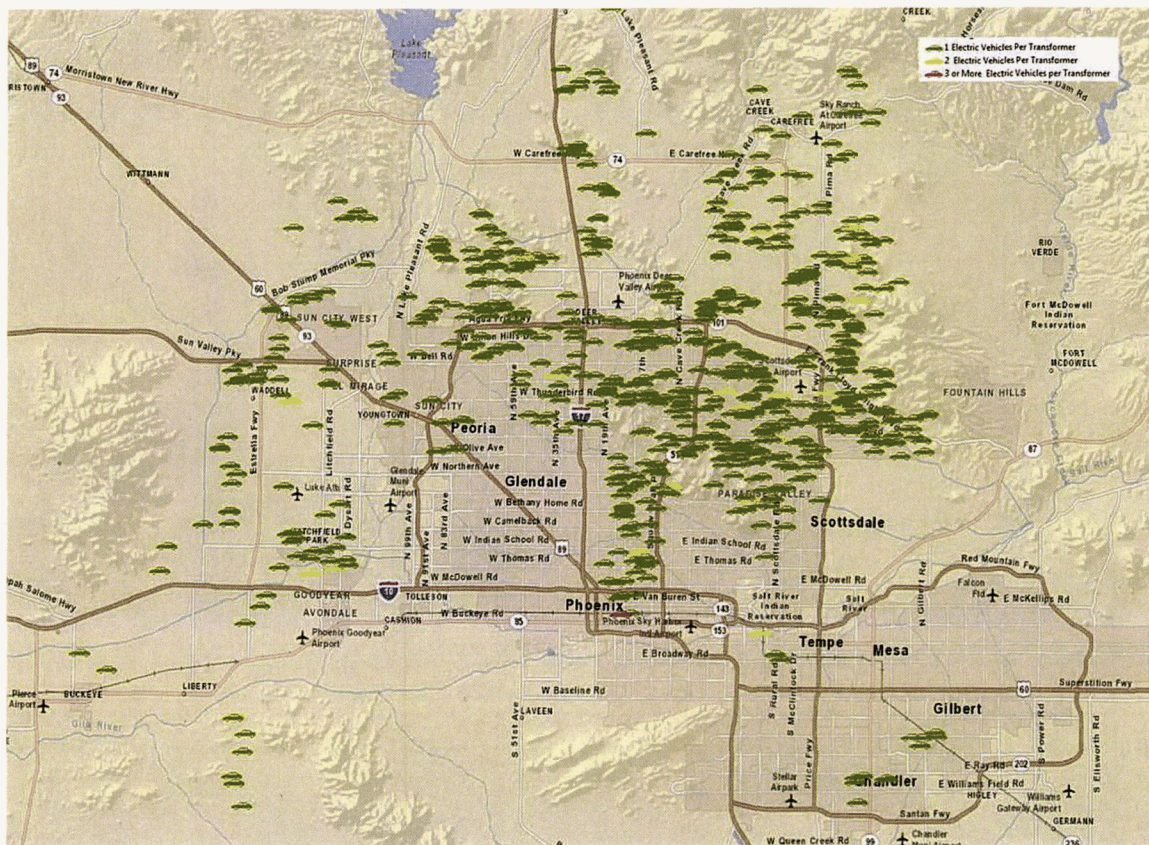




Figure 8. Distribution of Known Transformers Serving EVs in Metro Phoenix  
(APS Service Territory)



As explained in the Company's ev-READY Study, it is unlikely that a single vehicle charging during peak demand hours will create reliability issues on the distribution grid.<sup>9</sup> However, in a situation in which several EVs are clustered within a neighborhood, the probability of reliability issues increases.

Clustering refers to the adoption of EVs by additional homeowners in areas where one or more than one household has already adopted an EV, resulting in the potential for overload and failure of transformers. This phenomenon is also referred to as geographic clustering, which can occur long before EV market penetration matures.

To date, APS is aware of limited clustering of EVs. The Company has identified 30 neighborhood transformers that are carrying electric load for more than one EV – 23 of these in cases where a single household has purchased more than one EV. One transformer on the Company's distribution system hosts 11 electric vehicles at a commercial site that has the ability to handle the increased load. Of the seven instances where the

<sup>9</sup> The timing of EV charging is a key determining factor of possible grid impacts in neighborhoods. For residential customers, it is likely that an EV will begin charging as soon as it reaches home absent an incentive to charge at a later time.

transformer is carrying the load of two different electric vehicle owners, four are at an apartment complex. The other three are traditional clustering situations where neighbors have purchased an electric vehicle.

However, as the EV market matures and more vehicle models are released, the Company expects to encounter greater concerns with geographical clustering. As mentioned previously, the inclusion of the 1,365 EVs identified by the Polk sales data may indicate significantly more geographic clustering on the Company's distribution grid.

#### B. Availability of Public EV Charging Stations

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While the electric vehicle market is ramping up in Arizona, there has been a slower than expected deployment of public charging infrastructure. In 2013, the EV charging infrastructure market went through a shakeout as high profile charger manufacturers Ecotality and Better Place filed for bankruptcy. In contrast, Tesla, eVgo and ChargePoint expanded their market throughout the country.

In 2009, Ecotality was awarded \$99.9 million from the American Recovery and Reinvestment Act of 2009 for *The EV Project*. Through *The EV Project*, approximately 920 publicly available charging stations were estimated to be installed in the state as of the end of 2012; however, as of the end of 2014 only 556 public chargers had been deployed. These stations have been installed in the metropolitan areas of Phoenix and Tucson, Arizona and on the Interstate 10 corridor between the two cities.

This network of charging stations, known as the Blink Network, is the largest deployment of EV infrastructure in the state. In the Metro Phoenix area, Blink public charging stations have been installed largely at government or business properties. For example, several Blink Network stations are available in downtown Phoenix at the Burton Barr Library, the Phoenix City Hall garage, the downtown campus of Rio Salado College, the Two Renaissance office building, and the Arizona Department of Environmental Quality office.<sup>10</sup>

In 2012, Ecotality started charging fees for use of the charging stations as *The EV Project* funding was coming to a close. With the number of EVs using the Ecotality stations declining, a poor deployment record, and high levels of debt, Ecotality filed for bankruptcy in September of 2013. Their assets and *The EV Project* responsibilities were purchased by Car Charging Group in October 2013 for \$3.3 million.

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<sup>10</sup> A map of existing Blink Network public charging stations throughout the United States can be found at [www.blinknetwork.com/locator.html](http://www.blinknetwork.com/locator.html). The map is notable because the number of stations at each installation site is provided, along with real-time usage information to allow consumers to both find a station and know in advance if that station is available for immediate use.

Table 2. Public Chargers on Blink Network in Arizona as of 3/31/2014

	Public Level 2	Public DC	Total
Metro Phoenix	429	30	459
Tucson	91	0	91
Rural AZ	4	2	6
Total Arizona Deployment	524	32	556

Additional public EV infrastructure has been installed in the state by Coulomb Technologies, now known as ChargePoint. ChargePoint was the sponsor of the national EV infrastructure program *ChargePoint America*, which provided host families and businesses with charging stations at no cost and was funded through the American Recovery and Reinvestment Act (ARRA) through 2011. The charging stations installed in Arizona by ChargePoint have not been part of either *ChargePoint America* or *The EV Project*. ChargePoint previously operated an open network, meaning any charger manufacturer could host their chargers on the ChargePoint network. ChargePoint now offers ChargePoint brand charging stations operating on their proprietary network; in addition, ChargePoint has some partnerships with other manufactures like Schneider Electric who use the ChargePoint Network for their charging stations.

Table 3. Chargers on ChargePoint Network in Arizona as of 3/31/2014

	Public Level 2	Public DC	Total
Metro Phoenix	58	0	58
Tucson	8	1	9
Rural AZ	3	1	4
Total Arizona Deployment	69	2	71

In 2014, Tesla began deploying a network of Superchargers throughout the country. The Superchargers are DC fast chargers that are available for free to Tesla brand EVs with a Supercharger port. Currently, no other brand EVs are compatible with the Tesla chargers. Tesla has completed installations throughout the country to facilitate cross-country travel. As of March 31, 2014 Tesla has installed Superchargers at 10 locations in Arizona along the I-40, I-17, I-10, and I-8 corridors. These chargers are only accessible to Tesla brand EVs and are unavailable for other EV models. Tesla has installed 423 Supercharger stations in North America to date.



Figure 9. Tesla Superchargers in Arizona



Figure 10. Superchargers in the United States



EV Connect is a Los Angeles-based EV network and infrastructure company which has installed chargers throughout the country, with 22 level 2 chargers at three Northern Arizona University locations in Flagstaff. Permission from Northern Arizona University is required to access these stations.

GoE3 is an Arizona-based company that has initiated deployment of electric vehicle infrastructure. To date, GoE3 has installed three public level 2 chargers and two public DC fast chargers on the I-10 corridor between Tucson and Phoenix. Their goal is to have a national network of DC fast chargers connecting the largest US cities.

SemaConnect is a Maryland-based EV network and infrastructure company. SemaConnect has chargers throughout the country, but to date has installed only three public level 2 chargers in Arizona.

Volta Charging is another EV network and infrastructure company based in Hawaii. Their business model is to install the chargers and allow electric vehicle charging for free. These chargers are located at business locations to attract additional business. Currently, there are 10 Volta chargers in Arizona.

GE operates the GEWatts network. This network allows either free public charging or private charging. To date there are no publicly accessible GEWatts stations in Arizona.

eVgo, a subsidiary of NRG Energy, current has two level 2 public charging stations on the eVgo network at the NRG Energy headquarters in Phoenix, Arizona.

Other national electric vehicle infrastructure networks that have installed EV charging stations include Aerovironment (operates AV Network), Beam Charging, Greenlots, meritCharge, Opconnect, and SunSpeed Enterprises. To date, APS is not aware of an Arizona presence for any of these networks.

Better Place was an EV battery-swapping technology company based in Israel that was heavily funded and highly marketed. Better Place operated EV chargers in the US and Denmark and battery swapping stations in Israel. However, car manufacturers were not inclined to manufacture vehicles that allowed battery swapping. As a result, Better Place went bankrupt in 2013 and all assets were liquidated. The US chargers are now operated on the Opconnect network.

A map of EV charging stations in Arizona as produced by the Department of Energy's Alternative Fuels and Advanced Vehicles Data Center is provided in Figure 9. A map of EV charging stations in the Metro Phoenix area is provided in Figure 10.



Figure 9. Arizona EV Charging Stations as mapped by the Department of Energy<sup>11</sup>

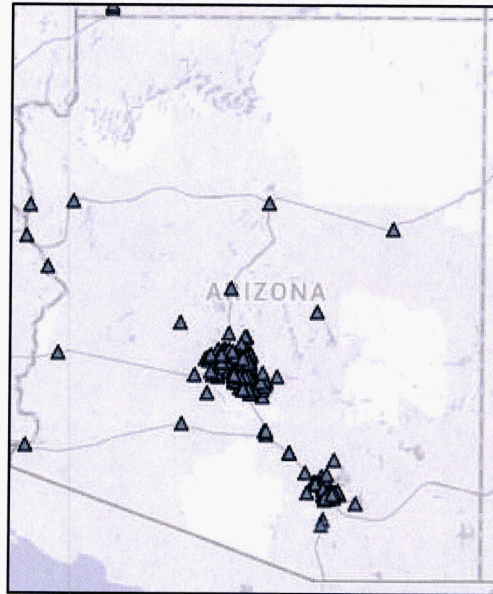
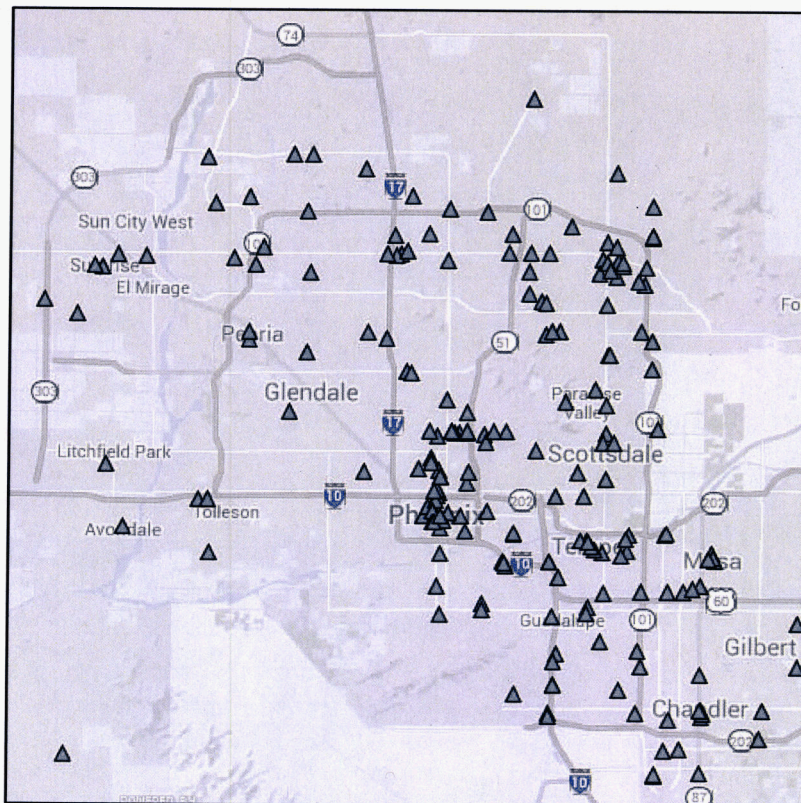


Figure 10. Metro Phoenix Area EV Charging Stations as mapped by the Department of Energy<sup>12</sup>



<sup>11</sup> For this and similar maps, please see [www.afdc.energy.gov/afdc/locator/stations](http://www.afdc.energy.gov/afdc/locator/stations).

<sup>12</sup> For this and similar maps, please see [www.afdc.energy.gov/afdc/locator/stations](http://www.afdc.energy.gov/afdc/locator/stations).



The Company's original ev-READY Study included a proposal to deploy APS-owned public EV charging stations throughout the APS service territory. This portion of the Study was designed to complement The EV Project by placing charging stations in locations where the project did not have plans to install EV infrastructure (to fill in gaps within cities and more evenly distribute availability of charging stations, and to place in APS service territory outside of the metropolitan Phoenix area). The proposed public charging station acquisition and deployment timeline was based on a forecast of EV sales in the Company's service territory. The Commission declined to approve this portion of the ev-READY Study, citing the uncertainty surrounding market penetration and customer adoption of EVs.

APS continues to believe utility-owned public charging stations may be appropriate in the near future to complement infrastructure deployment by federally funded projects and privately-owned chargers. The conclusion of *The EV Project* in 2012, lower than expected public charging station deployment through 2014, and commitments by auto manufactures to continually offer lower cost and increased range EVs may illustrate a need for the Company to have an expanded role in EV infrastructure support and development for Arizona to realize the potential benefits of widespread EV adoption.

However, at this time the Company does not have plans to install Company-owned public charging stations nor request approval of a point-of-sale pricing methodology for energy usage at these stations.<sup>13</sup> The Company will continue to monitor deployment of electric vehicle chargers and the number of EV sales in the APS service territory. In addition, the Company will evaluate potential programs in which the Company could play an increased role in EV infrastructure support and development and may request a similar charging station deployment program in the future.

### C. Customer Education and Outreach

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APS has developed several methods of communication in order to reach out and inform customers regarding the availability of EVs and their contribution to a cleaner environment, the various types of charging stations and under what circumstances a residential customer may wish to install a station at home, and the impacts EV ownership may have on individual electricity usage and neighborhood distribution systems.

APS maintains a robust website ([www.aps.com/ev](http://www.aps.com/ev)) which provides information about EVs, EV charging, and other basic information regarding EV ownership, including customer rate options appropriate for the EV owner.

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<sup>13</sup> "Should APS identify a gap in charging infrastructure deployment, or other deficiency in the federally-funded EV infrastructure efforts, APS may request approval of a public point-of-sale rate in APS' first annual report of Study findings to the Commission." *Decision No. 72582, page 15, lines 7-9.*

This website was redesigned in 2013 for greater customer ease of use. A dedicated e-mail account, [electricvehicles@aps.com](mailto:electricvehicles@aps.com), is available for EV owners to ask specific questions regarding their EV and their APS account. The Company has also partnered with leading automobile makers, other utilities, and battery and charging station manufacturers to establish a website to educate consumers, policymakers, and key industry sectors on the benefits of EVs. This website ([www.GoElectricDrive.com](http://www.GoElectricDrive.com)) contains comprehensive information about owning and operating an EV, including available federal and state incentives and other EV benefits.

Additionally, APS has developed a brochure to help explain Rate ET-EV. This brochure is available at public events, electric vehicle dealerships, and upon demand. A copy of the brochure is provided in Appendix A.

APS personnel also attend public events with Company-owned EVs to broaden public awareness of available vehicles, answer questions, and demonstrate the benefits of EVs.

APS personnel have also met with automobile dealers to discuss electric vehicles, discuss Rate ET-EV, and deliver ET-EV brochures. In 2015, APS will renew efforts to educate automobile dealers on the benefits of electric vehicles (including Rate ET-EV), as well as the importance of customers notifying utilities of their EV purchase.

## II. Rate ET-EV Analysis

The ev-READY study is designed to assist the Company and its customers in preparing for the expected increase in market penetration of EVs. Deployed as part of the ev-READY study, Rate Schedule ET-EV is designed to encourage drivers through financial incentives to move electric vehicle charging to super-off peak demand periods.

Rate ET-EV has an on-peak time period (Noon to 7PM), a super-off peak time period (11PM to 5AM), and off-peak time period (all other times). The rate is a whole house time-of-use rate that applies to all electricity used in the home. Currently, there are 189 APS customers on Rate ET-EV.

Table 4. Rate ET-EV Time Periods

TIME-OF-USE	MON. - FRI. <sup>1</sup>	WEEKENDS <sup>2</sup>
5 a.m. to Noon	Off-peak	Off-peak
Noon to 7 p.m.	On-peak	
7 p.m. to 11 p.m.	Off-peak	
11 p.m. to 5 a.m.	Super Off-peak	

<sup>1</sup> Excludes qualifying holidays <sup>2</sup> Includes qualifying holidays

A comparison between customer usage patterns for the standard rate and Rate ET-EV TOU is shown in Figure 11 below. This graph compares the average of all customers on the standard Rate E-12 and the average of all customers on Rate ET-EV from January 1, 2014 to December 31, 2014.

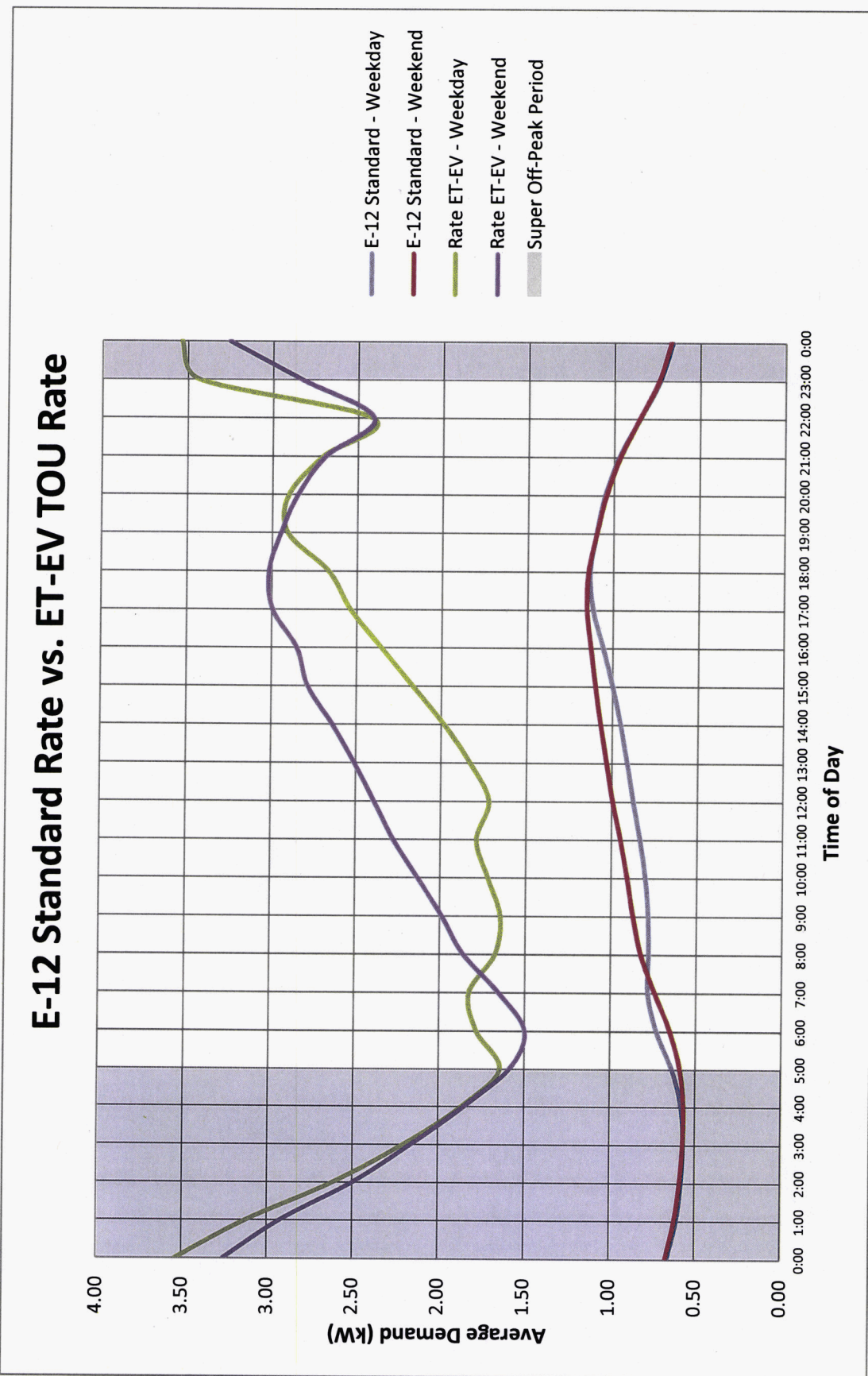
The graph shows that customers on Rate ET-EV have higher peak energy demand on average (3.7 kW) than customers on the standard E-12 rate (1.22 kW). This is consistent with expectations that early adopting EV customers are more likely to live in larger usage single family dwellings.

The observed peak for Rate ET-EV occurs around Midnight for both the weekday and weekend, as opposed to 6:00 PM for the standard E-12 rate. This is particularly interesting for Rate ET-EV, because the super-off peak period only occurs on week days. APS believes that customers are simply programming their vehicles to charge during the super-off peak time period and allowing charging at that time regardless of the day of the week.

Customers on Rate E-12 use an average of 20 kWh per day on the weekdays and 20.8 kWh per day on the weekends. This compares with 55.0 kWh per day on the weekdays and 58.6 kWh on the weekends for customers on Rate ET-EV.

Rate ET-EV has been an effective means of incentivizing customers to charge EVs in the super-off peak period where demand on the system as a whole is at its least. It appears that the current design of Rate ET-EV (i.e., a super off-peak differential of 2.265 cents/kWh) is adequate to achieve the Company's goal of driving EV charging to coincide with the time of lowest demand on the system. Therefore, at this time the Company recommends maintaining the current pricing and pricing periods in Rate ET-EV through a third summer season. APS will provide additional analysis of Rate ET-EV in its next annual report.

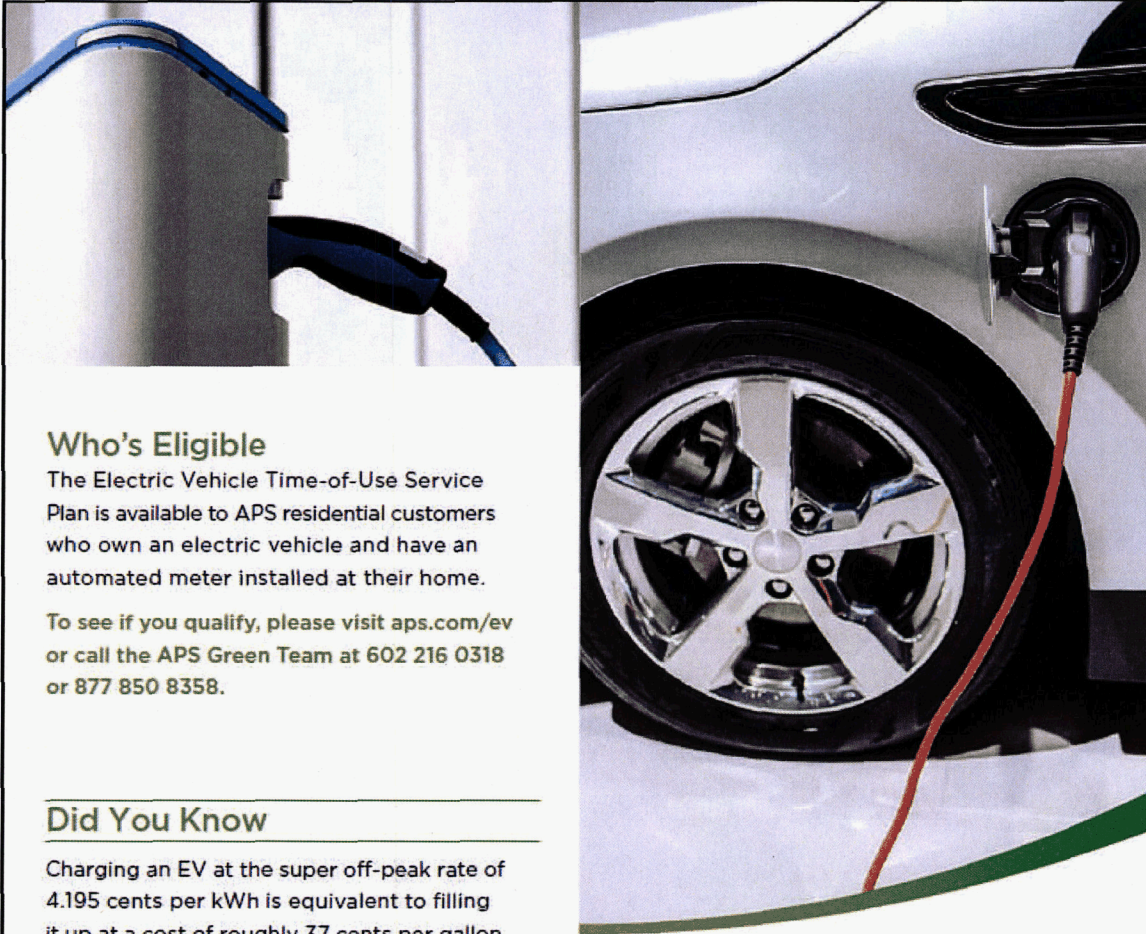
Figure 11. Standard Rate vs. Rate ET-EV





### III. Appendices

#### A. Rate ET-EV Brochure



**Who's Eligible**

The Electric Vehicle Time-of-Use Service Plan is available to APS residential customers who own an electric vehicle and have an automated meter installed at their home.

To see if you qualify, please visit [aps.com/ev](http://aps.com/ev) or call the APS Green Team at 602 216 0318 or 877 850 8358.



**Did You Know**

Charging an EV at the super off-peak rate of 4.195 cents per kWh is equivalent to filling it up at a cost of roughly 37 cents per gallon.

Source from EPRI 2007

The Electric Vehicle Time-of-Use Service Plan is a trial plan available through December 31, 2014. APS reserves the right to discontinue this service plan prior to the end of the trial period. Although the EV TOU service plan is designed to lower costs by offering a lower rate from 11:00 p.m. to 5:00 a.m. for EV charging and other purposes, APS is unable to guarantee that switching to this service plan will lower your actual energy cost. Neighborhood Electric Vehicles (golf carts) as described in A.R.S. §28-101(36) do not qualify for this rate schedule.

**Plug in for Less**  
ELECTRIC VEHICLE TIME-OF-USE  
SERVICE PLAN



CS#1209019

## Maximize your savings with the APS Electric Vehicle Time-of-Use Service Plan

You may already be saving on fuel. Now you can also save on electricity, too. The Electric Vehicle Time-of-Use (TOU) Service Plan is designed to help you reduce the cost of charging your electric vehicle. Not only does the service plan apply to the energy used to charge your vehicle—it also applies to your home's total energy usage, which means the savings can be significant.

### How it Works

APS residential customers who own an electric vehicle and have an automated meter can sign up for the Electric Vehicle Time-of-Use Service Plan. Customers who sign up for this trial plan are billed at rates which vary depending on the time of day when electricity is used. So, those who charge their electric vehicle during super off-peak hours will reduce the cost of charging the electric vehicle. Check the owner's manual or ask your dealer to determine if your electric vehicle can be programmed to automatically charge during super off-peak hours.

TIME-OF-USE	MON. - FRI. <sup>1</sup>	WEEKENDS <sup>2</sup>
5 a.m. to Noon	Off-peak	Off-peak
Noon to 7 p.m.	On-peak	
7 p.m. to 11 p.m.	Off-peak	
11 p.m. to 5 a.m.	Super Off-peak	

<sup>1</sup> Excludes qualifying holidays <sup>2</sup> Includes qualifying holidays

### Additional Savings

This plan can save you the most money on your household energy use, if you can:

- Keep your home's energy use to a minimum during on-peak hours.
- Set your programmable thermostat to a warmer temperature during summer on-peak hours and a cooler temperature during winter on-peak hours.
- Set times for major electric-powered equipment such as pool pumps, spa heaters and electric water heaters with timers set to run only during off-peak hours and super off-peak hours.
- Use major appliances (oven, range, dishwasher, clothes washer and dryer) mostly during off-peak hours.

Please visit [aps.com/ev](http://aps.com/ev) for more information regarding electric vehicles and the Electric Vehicle Time-of-Use Service Plan.